U. S. DEPARTMENT OF AGRICULTURE

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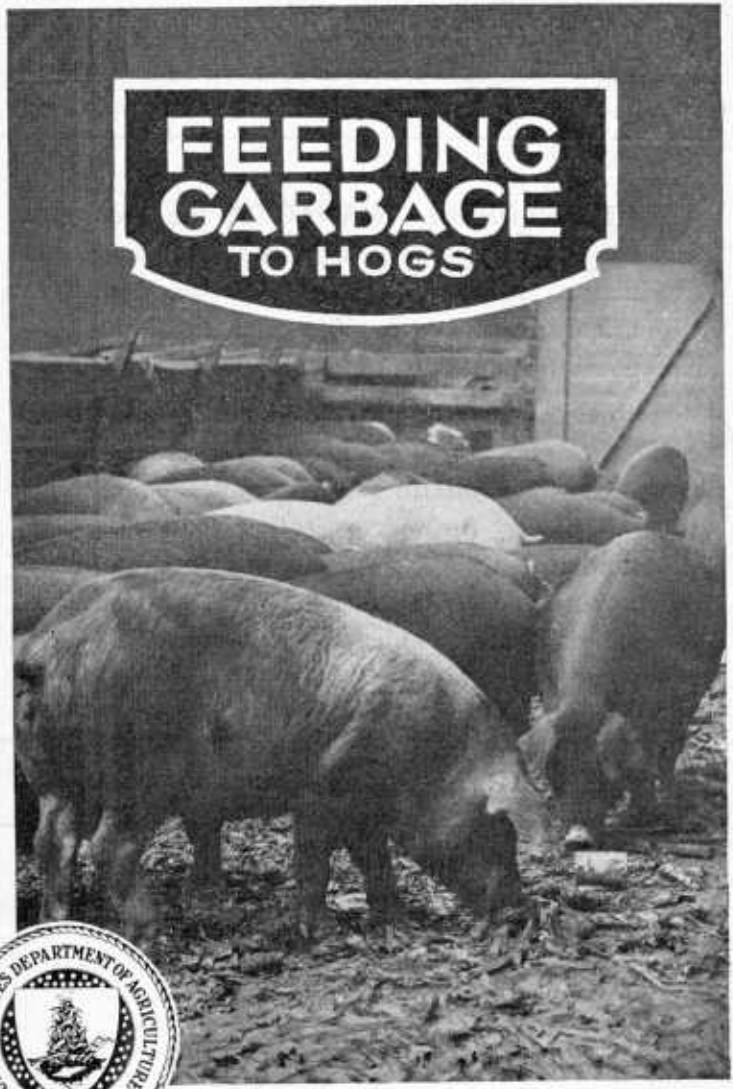
FEEDING GARBAGE TO HOGS



WHEN PROPERLY MANAGED, the feeding of garbage to swine is a practical means of pork production. In addition, it helps to solve a problem which confronts many cities and towns—that of effective and economical garbage disposal.

Methods of feeding garbage to swine vary considerably and are still undergoing changes and development. This bulletin sets forth the general principles necessary for success, rather than attempting to establish definite methods or to discuss details of hog raising. With the general principles in mind, the reader should be able to work out details to meet his particular conditions.

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FEEDING GARBAGE TO HOGS.

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CONTENTS.[1]

WASTE CONVERTED INTO AN EDIBLE PRODUCT.

GARBAGE is fed to hogs in a great many localities with varying degrees of success. The information given in this bulletin is intended to familiarize interested persons with the possibilities of the business when it is intelligently managed.

Feeding garbage to hogs in a proper manner makes possible the conversion of city waste into wholesome meat, thus giving back to the city a supply of food and at the same time affording the city an economical and efficient method of garbage disposal. Of 66 cities estimated as having populations in excess of 100,000 each in 1916, more than 30 per cent reported that their garbage was disposed of by feeding to hogs, and of the 544 cities of between 10,000 and 100,000 population from which reports were received by the United States Food Administration, more than 36 per cent made like reports. This means that even when the production in cities of less than 10,000 inhabitants is not considered, nor the suburban farm population which disposes of almost all its garbage by feeding, the waste food products from over 8,000,000 people are being fed to hogs. This product is sufficient, if handled and fed under ideal conditions, to produce approximately 80,000,000 pounds of pork a year. But experience shows

[1] Portions of this bulletin are based on information in the U. S. Food Administration bulletin, "Garbage Utilization."

that in actual practice scarcely more than 50 per cent efficiency may be expected, which means that about 40,000,000 pounds of garbage-fed pork is sold each year.

GARBAGE VARIABLE IN COMPOSITION.

Garbage ordinarily is all refuse accumulations of animal or vegetable matter which had been intended for human food. It is generally composed of scraps, peelings, fruit remnants, and spoiled food, and is rather variable in composition. Ashes, paper, manure, and street sweepings are not included in the definition of the term "garbage."

FIG. 1.—A typical cartload of municipal garbage collected in summer.

The composition of garbage depends largely on its origin and the season of the year. Garbage from hospitals and institutions is of excellent quality, as is also that of Army camps. Hotel and restaurant garbage, on an average, is next in food value, and ordinary municipal garbage is somewhat lower.

Analyses of cantonment garbage, by the Bureau of Chemistry, give the following composition on an air-dry basis:

	Per cent.
Protein	15 to 18
Carbohydrates	31 to 69
Fat	13 to 33
Ash	16 to 36

A sample of municipal garbage from Louisville, Ky., analyzed by the Kentucky experiment station, showed the following results, on an air-dry basis:

	Per cent.
Protein	21.5
Carbohydrates	41.8
Fat	23.4
Ash	13.3

VALUE OF GARBAGE FOR FEED.

A person considering a garbage-disposal contract is preparing to take certain risks and the risks warrant a commensurate return on his money.

In most cases it is believed that the value of the garbage will not be sufficient to pay the cost of collection and transportation. When

FIG. 2.—The same garbage as shown in the preceding figure, spread out. The method of feeding and the equipment illustrated are typical of what may be expected from short-term contracts.

a contractor both collects and disposes of the garbage it is unlikely that the work will be done without cost to the city unless the quality of the garbage is exceptional and there is keen competition for the material.

Experience shows that 50 pounds of garbage may be expected to produce 1 pound of marketable pork, live weight. With pork on the

hoof at 10 cents this would give gross value of $4 to a ton of garbage, less the cost of labor and materials at the farm, haul involved, interest on investment, and depreciation on buildings.

HOUSEHOLD CARE OF GARBAGE.

The wholesomeness of garbage depends greatly on the care it receives in households. Tin cans, glass, paper, oyster shells, sawdust, soap, and other foreign materials when mixed with garbage may cause numerous losses of hogs.

The problem of keeping garbage free from injurious articles is primarily one for municipal control, involving suitable announcements to the public that garbage is being fed, enlisting the cooperation of civic bodies, and the enforcement of ordinances bearing on the proper care and handling of garbage.

Undoubtedly a great deal of the difficulty with the mixed material is due to carelessness, but the admixture of some of the objects mentioned can not be due to it entirely. Broken crockery, cutlery, paper, and meat skewers are not naturally associated with garbage. A large part of the trouble is due to the householder's lack of knowledge that the garbage is being fed and that foreign products in it are injurious.

It is important, therefore, to keep the public continually advised that the garbage is being fed. Individual cases can be handled usually by a courteous notice that the materials found with the garbage are very injurious to hogs. Word to the local press that one or more hogs have died from eating foreign material in garbage will generally be treated as "news," and the public will be reminded of its responsibilities. The various civic officials must give their hearty cooperation, and their notices to the public should explain that there is a reason for the various ordinances, that they are not simply "red tape," and a great improvement will be observed.

The requirements should make garbage noncollectible if it contains harmful materials or is so handled that injury to hogs may result. In addition to the foreign articles already mentioned, dish water should be excluded. Water not only adds to the per ton cost of collection but is likely to contain lye, strong soap, or washing powders—things which are not good for the digestive system of hogs.

In line with the policy of keeping out water the receptacles should be kept covered. This should be done for the further reasons that garbage in a well-covered receptacle is inaccessible to stray cats or dogs, is fly proof, and confines odors. Obviously such receptacles should be made of rust-resisting metal and kept water-tight.

FREQUENCY OF COLLECTION.

Aside from sanitary reasons, the frequency of collection is important in that fresh garbage has greater feeding value. In northern cities collection should certainly be made three times a week during the summer months. Once a week during cold weather might be sufficient from the feeding standpoint, but household requirements warrant at least two collections a week. In southern cities daily collection should be made during hot weather, while

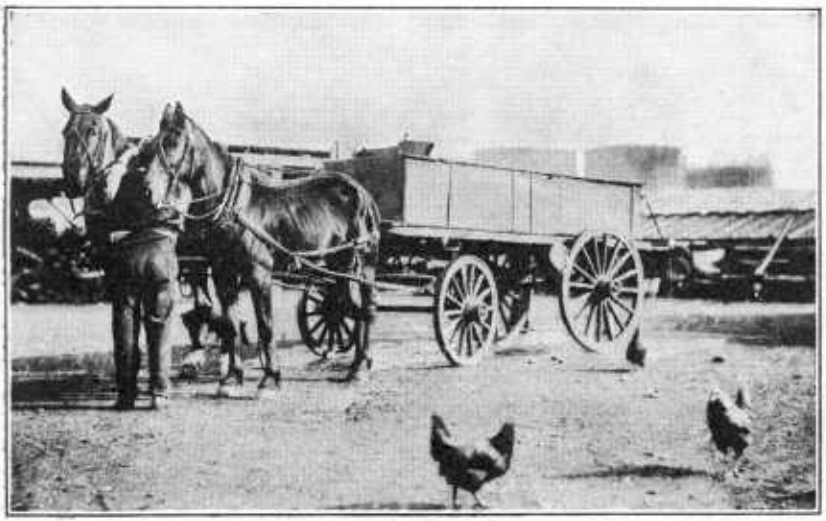

FIG. 3.—The tank type of wagon is especially well adapted for hauling garbage.

three a week may be sufficient in the winter. Because of its more rapid accumulation, as well as superior quality, garbage from hotels and restaurants may well be collected daily.

If the disposal of garbage by feeding lowers the cost of disposal in any city, the question of using such savings for more frequent collections deserves consideration. The greater food value of fresh garbage is, of course, the chief reason for frequent collection.

WHO SHOULD MAKE COLLECTIONS.

It is generally advisable for the city to collect garbage by municipal facilities, even though its disposal by contract is deemed advisable. The municipality can generally overcome collection difficulties better than a contractor. With contract collections details must be definitely stipulated, and they are not so readily changed when conditions vary. With municipal collections changed conditions can be met more readily.

It is believed also that more competition can be obtained on a contract for disposal only than on a contract for both collection and disposal. The difficulties experienced with disposal are not so detailed as with collection.

METHODS OF UTILIZING GARBAGE AS A HOG FEED.

There are two feeding methods worthy of consideration, the first by the municipality, the second by the individual, association, or corporation. Contracts made individually with a number of feeders

FIG. 4.—A type of wagon that should not be used for hauling garbage.

are unsatisfactory and lead to difficulties. This has been tried in a number of places and found disadvantageous to both the city and the contractors.

In the first place the amount of garbage produced varies from season to season, and even from day to day. It is difficult to proportion this varying quantity among a number of feeders when each feeder must provide stock enough to consume the maximum amount which he might receive on any given day. It is impossible also to prevent a surplus if a certain feeder sells his stock and leaves the city with an accumulation of garbage and no way of disposal. With a number of individual feeders no heavy bond can be obtained by the city.

DISPOSAL STIPULATIONS.

In making contracts for disposal by feeding a comparatively long-time contract is advisable. It is obvious that with one-year con-

tracts the cost to the city must be excessive as compared with a longer period, since the contractor must cover the cost of his equipment in the price bid.

An additional advantage of comparatively long contracts or municipal operation is that sanitary standards can be insisted upon, which, because of their cost, would be prohibitive with a one-year contract. With a one-year contract cheap shelter, fences, and equipment will have to suffice. With a contract for a longer period the city can stipulate and the contractor would be willing to furnish structures of a more permanent type.

Any contracts to be awarded, however, should require standards that would permit no nuisance at the plant. Obviously in a settled community the opportunity for a nuisance would be greater than in a strictly suburban territory, and stricter standards would be needed. A suburban location for a farm is therefore more desirable, but lengthens the haul and thus increases costs. With wagon or truck haulage, distance is an important factor, but if the garbage has to be transferred from the collecting vehicles to rail transportation, the distance of the farm from the municipality is not so important, the cost to transport 5 miles being little less than to transport 20 or 25.

LOCATION OF FARM.

A hog farm should be located on soil that drains readily, preferably sand or gravel. Likewise, because of better drainage, it is advisable that the land be rolling. Quarters for the hogs should be located for warmth in winter and coolness in summer.

Garbage-fed hogs require abundant drinking water. If any streams or brooks are included in the property they should be carefully traced and their purity established or else fenced off so that the animals will drink pure water otherwise supplied. Although any practical method of watering may be used, automatic drinking fountains have several advantages, among them being the ability to keep the water from freezing in winter.

The size of the farm necessarily varies with the system of handling. With feeding outdoors in all but extreme weather, about 50 pigs per acre is a good working average. Under cover the number can be increased to from 400 to 600 an acre.

EQUIPMENT.

The type of shelter and feeding equipment depends largely on the climate, nature of the contract, and future plans for the development of the farm. The equipment for a hog-feeding establishment where

swine are fed but not bred and raised is somewhat simpler than when arrangements must be made also for brood sows and their litters.

The essentials of shelter, as for the ordinary hog farm, are dryness, warmth, and general comfort. In cold weather the hogs should have access to a shelter free from rain and snow and where they will find warm, dry bedding. Equipment may include self-feeders, troughs, or platforms, depending on personal preference and the kind of garbage fed. All the methods are used with varying success, but platforms appear to be best adapted for feeding ordinary mixed garbage. Garbage fed on platforms is more readily accessible to the animals. Self-feeders are likely to need attention to prevent

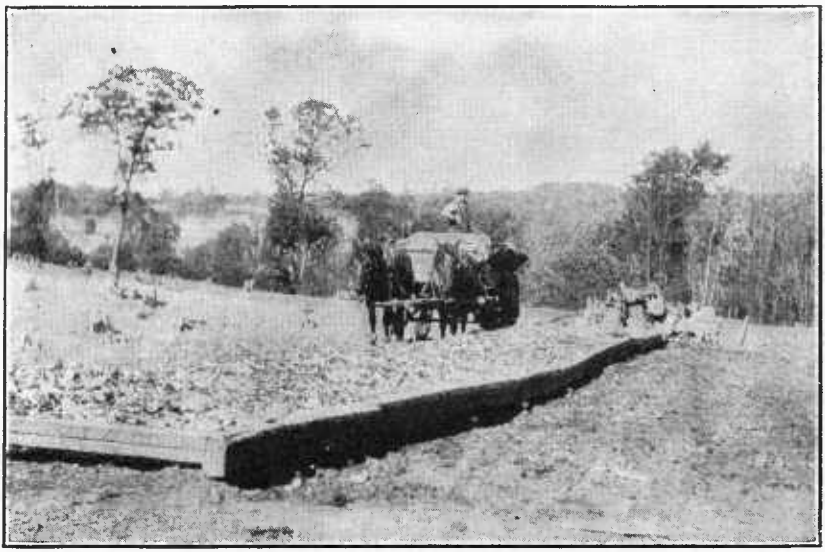

FIG. 5.—Spreading the garbage on portable feeding floors, Home Farm, Worcester, Mass.

clogging when the garbage contains melon rinds or corncobs or in case the garbage freezes. Troughs are still less desirable but are sometimes used for feeding garbage that is semiliquid.

With long-time contracts more pretentious equipment can be installed, permanent rather than temporary houses may be erected, and concrete instead of board platforms provided. In such event the breeding and raising of the stock would probably be undertaken and at least one of the houses provided with heat and artificial light. Under no conditions, however, should the animals be kept in small pens. Considerable range is necessary for the successful operation of a piggery where garbage is fed, though fattening stock may be kept in close confines for a limited time.

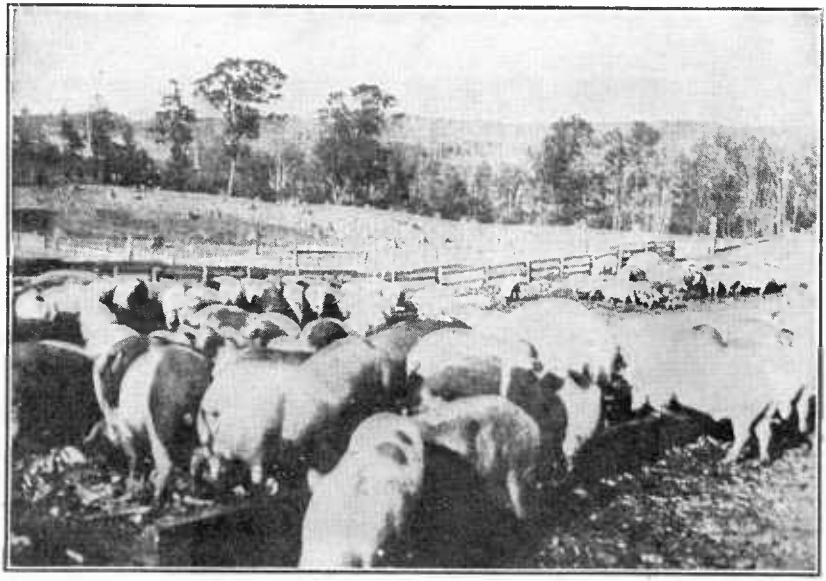

FIG. 6.—Hogs eating garbage from the portable feeding floors, Home Farm, Worcester, Mass.

BREEDS TO BE USED.

Practically every breed of hog is fed successfully on garbage. The tendency is to cross the short-bodied hog with the bacon type. In some instances the boars are of the short-bodied type, while in other cases short-bodied sows are used.

With short-term contracts, the tendency is to buy stock at from 75 to 100 pounds in weight, and the effort is to get a thrifty hog that

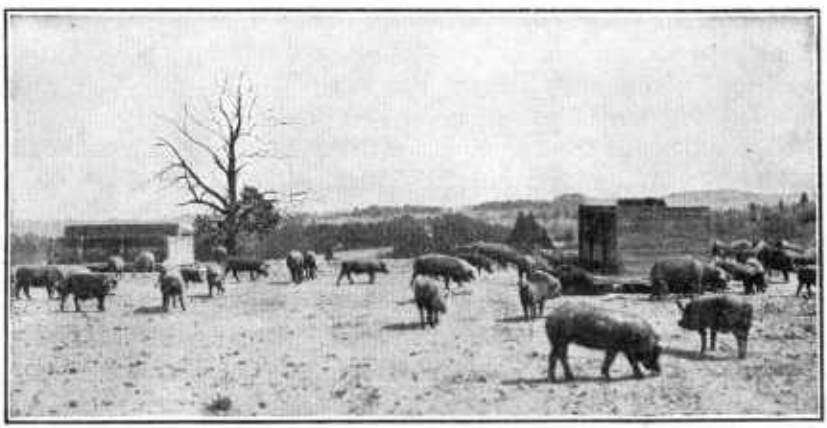

FIG. 7.—Portable self-feeders, an inexpensive type of garbage-feeding equipment.

will put on weight rapidly. The number of pigs raised to maturity with garbage-fed stock is about the same as with grain-fed.

BUYING COMPARED WITH RAISING FEEDERS.

There is a difference of opinion among garbage feeders as to the relative merits of hogs raised on garbage from the time of weaning and those purchased on the market at about 100 pounds in weight. Some assert that the garbage-fed hog has not the strength of the other hog; others will handle feeders only when their regular stock is unable to consume the amount of garbage available.

A hog accustomed to garbage early in his life should be the more successful as a rule. The feed is more bulky than grain and requires

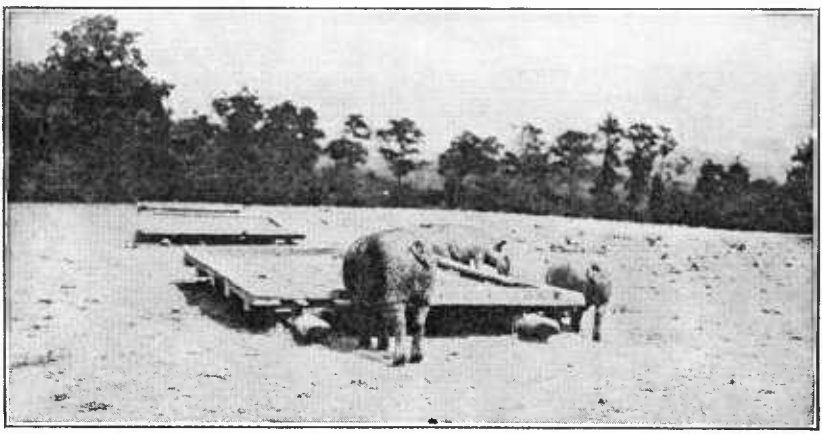

FIG. 8.—These inexpensive portable platforms were used in the same feed lot with the self-feeders shown in figure 7.

a greater stomach capacity if the same amount of nourishment is to be assimilated. The hog raised on garbage is started as a garbage-fed pig, and his stomach is capable of being distended far beyond that of a grain-fed hog of equal age.

Feeders who purchase the greater part of their stock generally get hogs when they are at an age and weight at which they can make the largest and most profitable gains. There is, however, a possibility that feeders will have considerable difficulty in purchasing the kind of animals they desire for feeding. In buying pigs, the buyer near the point where a considerable number of hogs are placed on the market has a distinct advantage. Local conditions will undoubtedly be the greatest factor in deciding this question. If the farm is operating on a one-year basis the expenditure for equipment necessary for raising is not justified. Pigs can be purchased more cheaply. If several years of operation are certain, raising the animals may

prove the cheaper. Satisfactory results are obtained under both systems; the management is the essential factor.

METHODS OF FEEDING.

The two general methods of feeding depend primarily on how the material is delivered to the farm. When in wagons or in motor trucks it will probably be advantageous to have what are known as feeding lots. These lots are about an acre in size and contain one or more feeding platforms, made of lumber and of sufficient size to hold a load of garbage as delivered. The platforms are on skids and have a low rail, a 2 by 4, nailed on edge, to prevent the garbage from being shoved off the platform.

FIG. 9.—Permanent hog houses used on the Home Farm, Worcester, Mass.

The pigs are permitted to enter the feeding lot only after the garbage has been dumped and the vehicle has left the lot. This prevents injury during unloading and keeps garbage from being thrown on the pigs.

Before the next feeding time the hogs are driven out of the lot, any bones from the garbage are gathered, and the platform cleaned. The platforms are moved from time to time to different locations and different lots. The lots vacated should be plowed, thus eliminating the danger of odors from spilled garbage and in addition retaining the fertilizer value of the garbage and manure. The lots plowed should be sown to some forage crop and eaten off by the hogs.

Where delivery is made in carload lots the labor expense of rehandling the garbage may be so great that it will be more advisable to have the feeding platforms adjacent to the railroad tracks. Plat-

forms that are not to be moved should preferably be of concrete and be ample in size. Narrow platforms or troughs in time become so eaten by the garbage juices that they are hard to clean. Besides, it is much better to spread the material out on a flat surface where the hog will have an opportunity to select his feed.

When garbage can be graded the best of it should be fed to fattening stock or to sows with young pigs. When open-lot feeding is practiced this is a simple procedure, since the material collected in the better portions of the city can be reserved for these particular purposes. With carload lots the same effect is produced by first

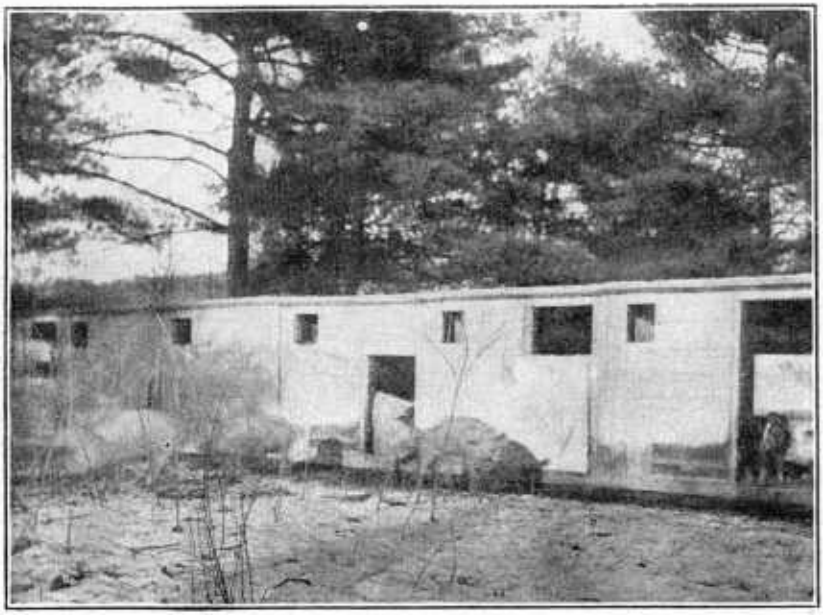

FIG. 10.—Individual houses used collectively on the Home Farm, Worcester, Mass.

admitting only the fattening stock to the platforms. After these animals have become satisfied a second lot, such as young shoats, is let in. In the same way a third or even a fourth lot is given an opportunity. Not only is the better garbage eaten by the stock that needs it most, but the garbage is eaten more closely. The last lot, generally brood sows, is kept more hungry and can be relied upon to clean up all edible material remaining.

The feeding of frozen garbage during the winter months is not advisable. It may be unavoidable, but it must be remembered that before this feed can be digested its temperature must be raised to that of the stomach. This requires a certain amount of energy, more cheaply supplied by artificial means than by the body heat of the animal. Much frozen garbage is fed, but less gain in weight is

obtained. If the material is thawed before feeding, the gains are asserted to equal those of other seasons of the year.

NUMBER OF ANIMALS PER PEN.

The losses due to "piling up" are so heavy that most hog raisers have very positive ideas as to the number of animals per pen. Some say that as low as 10 is the number to be allowed in a shelter 10 by 20 feet, floor dimensions.

Individual pens should be provided for each brood sow, or at the most two sows should share the same pen. Upon being weaned the

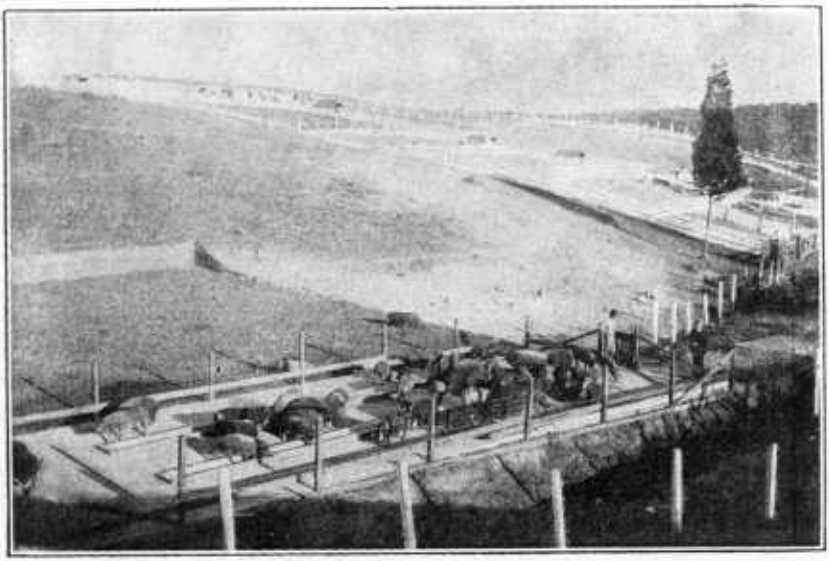

FIG. 11.—Sanitary hogpens and feed lots are essential to successful hog raising. (Photograph by courtesy of District of Columbia Workhouse Farm, Occoquan, Va.)

young pigs may be kept 8 or 10 to a pen until about 2 months old. Efforts should be made to keep in each pen pigs of approximately the same size. When between 60 and 75 pounds in weight they can be turned out into comparatively large lots, one-half acre or more. The larger the animals the more can be put together in a single inclosure without danger to their development. Records indicate that as high as 500 or 600 animals have been kept in a single inclosure without sufficient piling up to cause harm.

STERILIZED COMPARED WITH RAW GARBAGE.

There has been considerable discussion throughout the country on the desirability of sterilizing garbage before feeding, but the best evidence is in favor of feeding garbage raw rather than cooked. At practically all farms where sterilizing apparatus was formerly

installed, at considerable expense, it is no longer in use. The difficulty is this: Sterilization causes injurious acids or other soluble substances of harmful nature to spread throughout the garbage. Raw garbage, on the other hand, better enables the hog to use his powers of feed selection and to refuse any ingredients that are unappetizing or are an unnatural feed. These remarks apply especially to soap, coffee grounds, acids in fruit skins, and spoiled products. Persons who are not familiar with hogs do not usually realize the remarkable instinct which these animals display in choosing feed which is beneficial when they have opportunity to do so. The most successful hog raisers give their animals a great amount of latitude in selecting their feed, and obtain the best and most economical results by so doing.

As regards carefully graded garbage from hotels, restaurants, and Army camps, sterilization does not seem to be so objectionable. This, however, is a special type of garbage.

Experimental evidence also, from the standpoint of daily gains in weight, slightly favors feeding raw garbage.

Briefly, cooking is an expensive operation and is regarded by many successful feeders as useless and even injurious, owing in part to the formation of organic acids. They agree that cooking causes the material contained to be so thoroughly mixed that it is impossible for the hogs to make selection in eating. A hog can balance its ration on raw garbage, whereas, if the material is cooked, the hog has no choice in the selection of its feed. These comments do not apply to moderate heating for the purpose of thawing frozen garbage to make it more palatable and more readily eaten.

GAIN IN WEIGHT PER POUND OF GARBAGE EATEN.

A number of careful tests have shown that a gain of about a pound a day can be expected with growing hogs fed on garbage, provided there are no losses. This means roughly that a ton of garbage will produce 100 pounds of gain on a live-weight basis. It does not mean, however, that tons of garbage as produced multiplied by 100 equals the live weight to be put on the market. A certain percentage of loss in stock is always to be expected and even with the fullest cooperation with householders and city officials, a certain amount of inedible material and even inedible garbage will always be present.

Some feeders state also that the quality of the garbage now produced is not so good as that of a few years ago, and that more garbage must be eaten to produce a pound of gain. Though not definitely established, it is reasonable to conclude that high prices result in a lower quality of food reaching the garbage can. We recommend that to cover losses and a possible decrease in the quality of the garbage

fed, the amount of marketable live weight be placed at 1 pound to 50 pounds of garbage. With careful management the ratio could be narrowed considerably.

USE OF SUPPLEMENTARY FEEDS.

Most garbage is more or less a balanced ration and no supplementary feeds are required. We find, however, in a number of places that animals are finished off on corn, barley, wheat middlings, or similar feeds. As a rule no other feed than garbage is provided. With hotel garbage and other special garbage a certain amount of roughage may be desired or even necessary. The opinions of different hog raisers vary greatly; the personal qualifications of the manager appear to be the most important factor.

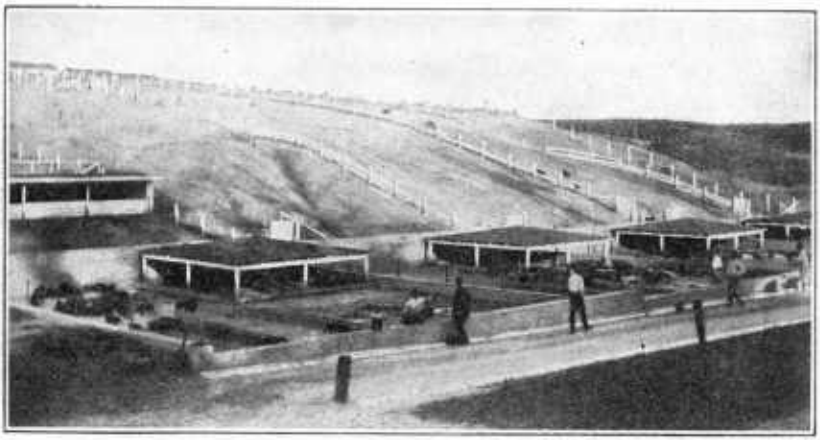

FIG. 12.—Swine can be raised on farms that are somewhat rolling. (Photograph by courtesy of District of Columbia Workhouse Farm, Occoquan, Va.)

Tests to determine the value of supplementing garbage with grain were conducted at the Michigan, New Jersey, Mississippi, Kentucky, and Iowa experiment stations. There were 140 pigs used in all of these tests. The feeding periods varied from 20 days, the shortest feeding period, to 211 days, the longest period. The supplementary feeds used were shelled corn, barley, middlings, corn meal, and forage crops.

In the case of garbage alone 23,534 pounds of garbage produced 1,162 pounds of pork (live weight), which was at the rate of 2,025 pounds of garbage to 100 pounds of pork (also live weight). In the case of garbage and grain 438.5 pounds of grain and 21,329 pounds of garbage produced 2,169 pounds of pork. This was equivalent to 202 pounds of grain and 983 pounds of garbage, producing 100 pounds of pork. A calculation from these figures shows that 100

pounds of grain equals 516 pounds of garbage when the grain is fed as a supplement.

The feeding value of garbage, especially the better grades, is such that it is seldom economical to use a grain supplement. However, when grain is reasonably low in price, good results might be obtained by feeding garbage alone during the summer months, when there is ordinarily a large production of garbage, and then finish the hogs on a grain ration. Greater gains per day can be made with grain supplements, but at a greater cost than on garbage alone.

QUALITY OF PORK PRODUCED.

We have not been able to find any market where garbage-fed hogs are generally sold at a lower price than grain-fed animals and there is no logical reason why garbage should be bad for hogs.

Garbage-fed hogs were raised at the experiment station of a Middle Western State and marketed at the same time as hogs fed corn and other grains. The carcasses of the garbage-fed hogs could not be distinguished from corn-fed hogs by the experts of one of the large packing houses, and were given even a higher grading than some of the hogs fed on certain grains.

Hogs fed garbage at the New Jersey station were slaughtered at the end of the test. Expert meat judges from two well-known packing concerns in the East inspected all cuts of meat. Little or no criticism was offered on any of the carcasses. It so happened, however, that in two instances carcasses which had been fed on cooked garbage were referred to as being a trifle light in color, while two carcasses from the grain-fed lot were criticized for lack of firmness and fineness of texture in both fat and the muscle tissue.

The Mississippi station sold a lot of garbage hogs on the St. Louis market. All the carcasses were firm and the dressing per cent of these hogs varied from 76.66 to 81.04.

An objection sometimes raised to garbage-fed hogs is that the hogs are liable to be infested with trichinæ. It is true that isolated cases have been found, as in grain-fed stock, but we do not believe that there is any evidence to-day that shows garbage-fed hogs as a class to be more commonly affected with trichinosis or tuberculosis than grain-fed hogs. The health officer of a large New England city which disposes of its garbage by feeding says: "I believe garbage-fed pork is as wholesome as any that can be obtained. I eat it myself when I get it, and I wish I could afford more of it. I do not see any grounds for the belief that such pork is unwholesome." Thoroughly cooking pork from any source destroys all danger from the parasite causing trichinosis. The Department of Agriculture urges thorough cooking and condemns the practice of eating raw pork.

HOG CHOLERA AND GARBAGE FEEDING.

Every garbage feeder should realize that the material he is feeding may contain raw scraps of meat from hogs that were infected with cholera, and that instead of being exposed to the disease once or twice during their lifetime his animals may be exposed daily. Immunization is accordingly far more important than in the case of grain-fed stock. Garbage feeders must recognize that their hogs are exposed constantly and that immunization is highly important for safety.

Some successful garbage feeders use the single or serum-alone treatment and aim to repeat about every 6 or 8 weeks. This is expensive from the standpoint both of labor and cost of serum used, as the immunity conferred may not last longer than 4 weeks and its effectiveness is doubtful. Best results are obtained by using the simultaneous or combined serum and virus treatment. Experienced men, using good potent serum and virus, can vaccinate a herd of hogs by this method and obtain permanent immunity with a very small percentage of loss. Incompetent practitioners or careless methods, on the other hand, may be the means of spreading the disease.

Actively immune sows transmit to their offspring a passive or temporary immunity. As a rule this immunity will last until weaning time and in some instances it may persist somewhat longer. Before the pigs are weaned the single or serum-alone treatment may be given, to be followed later by inoculation with the simultaneous method, or the simultaneous treatment may be given in the first place and the serum-alone treatment omitted.

We find that where selected garbage is fed, even if efforts to sterilize by cooking have been made, a great deal of trouble is experienced when immunization is not practiced.

Because of the lasting immunity conferred, the simultaneous treatment for cholera control in hogs fed on garbage is preferable to the "serum-alone" treatment. The cost is practically the same.

The doses of both virus and serum should always be ample. It is of the highest importance that virus of full virulence be used in treating hogs kept under garbage-feeding conditions.

TUBERCULOSIS AND OTHER DISEASES.

Dependable estimates indicate that 90 per cent of the hogs raised in Massachusetts are fed on garbage, yet statistics show that of more than 10,000 hogs slaughtered in 1917 under inspection in that State only 169 were found to be infected with tuberculosis.

Hogs contract tuberculosis principally from cattle, either by following tuberculous cattle in the same lot, by consuming unpasteurized skim milk from cows having tuberculosis, or by feeding on diseased carcasses. The feeding of garbage is considered to be an uncommon cause of tuberculosis in hogs, and the short duration of the average feeding period greatly reduces the probability of losses from that disease.

To avoid pneumonia, the main effort, as with grain-fed hogs, is to prevent the animals from becoming overheated and then cooling

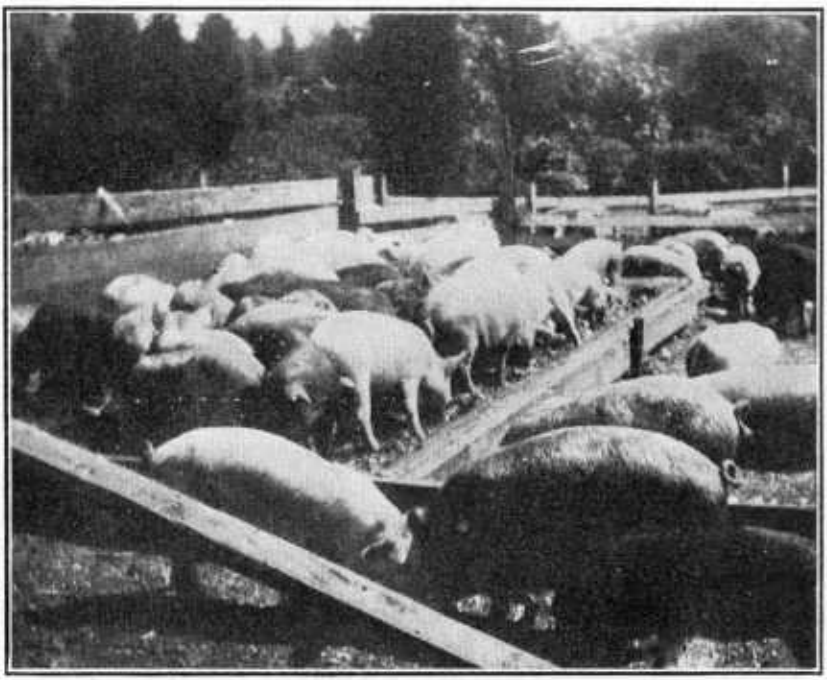

FIG. 13.—Hogs eating garbage from platforms, Hull, Mass.

off too rapidly. Practical measures of avoiding it are good ventilation, dry sleeping quarters, sanitation, and prevention of overcrowding. As well as being undesirable for nutritive reasons, the feeding of frozen garbage has a tendency to lower the vitality of the animals, and makes them more susceptible to disease.

Cholera, it should be remembered, is not the only disease to which hogs are susceptible; consequently simultaneous inoculation will not prevent all losses. It is highly desirable, therefore, to feed garbage in such condition and care for the hogs in such manner that the vitality of the animals may be kept to the highest point.

Diseases other than cholera can be expected to appear among garbage-fed hogs in about the same degree as with grain-fed stock. The treatments are identical and the same care is required.

SANITARY STANDARDS.

In garbage, which spoils easily, sanitary measures are relatively more important than with a practically sterile grain. Manure and uneaten garbage should be cleaned up every day and either composted with dry earth or spread on the ground and immediately plowed under.

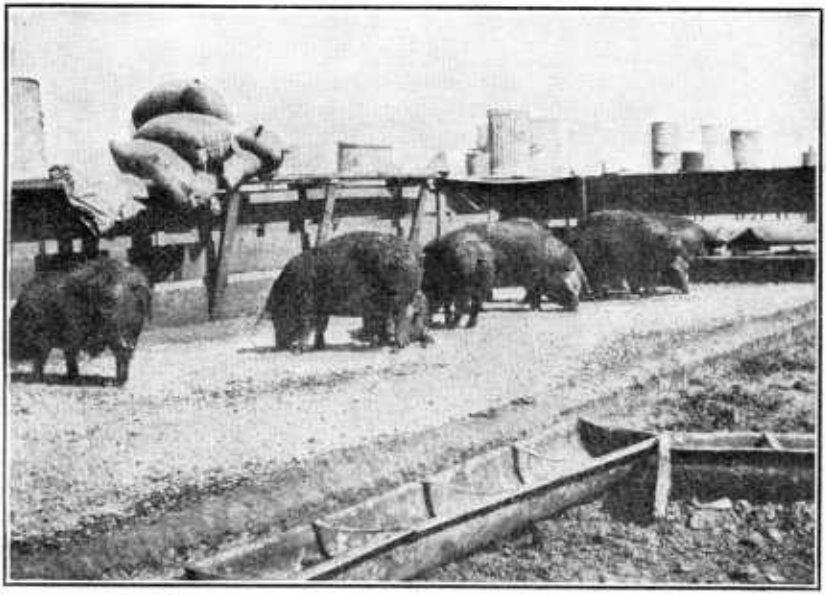

FIG. 14.—Feeding pens at the garbage plant, Fort Bliss, Tex.

The paint pot and whitewash brush at a pig farm can not be too much in evidence for the safety of the herd. Efforts should be made, likewise, to keep rats, crows, and buzzards under control. It is advisable to make buildings ratproof.

ESTIMATES OF EXPENSE AND REVENUE.

Any estimates of the cost and returns from garbage disposal are so dependent on the conditions in the community that figures for one locality can not be regarded as dependable for another. The following general statement, however, illustrates a typical case. The figures deal with garbage disposal by feeding as practiced in Worcester, Mass. This city is selected because of the successful

operation of its municipal piggery and more particularly as it came to be used to illustrate the values recoverable in successive years of operation.

Statement of garbage-feeding conditions at Worcester, Mass.

Population	185,000.
Area	38.4 square miles.
Topography	hilly.
Frequency of collection	twice a week.
Distance of farm from the city	3½ miles.
Distance of farm from the center of garbage production	6½ miles.
Cost of collection (including haul to farm)	$7.25 a ton.
Area actually used for pig farm	40 acres.
Quantity of garbage fed, 1917	6,514 tons.
Minimum number of hogs in herd	2,000.

(Only about 60 per cent of garbage produced was fed at farm, the remainder being fed by private collectors.)

Approximate investment in disposal equipment.

Forty acres at $100	$4,000
Buildings, fences, etc	35,000
Other equipment	1,000
	40,000

Operating expenses (1917).

Six caretakers at $840	$5,040
Additional labor	900
Grain and bedding	1,896
Serum and virus	2,581
Repairs to buildings	1,000
Miscellaneous, supervision, light, heat, interest, teaming	3,500
	14,917

Revenue and expense.	Total.	Per ton fed.
Revenue	$51,737.33	$7.94
Expenses	14,917.91	2.29
Difference	36,819.42	5.65

In 1915 the entire herd had been disposed of and Worcester started in to build up a new herd under conditions almost similar to those to be faced by any one first going into the proposition. The following figures cover the principal revenues:

Revenue from September 1, 1915, to December 1, 1917.

Swine sold, 1916	$13,212.84
Swine sold, 1917	44,487.33
Insurance on stock lost by fire	4,350.00
Stock on hand December 1, 1917 (2,110 head)	42,000.00
	104,050.17
Less stock purchased September, 1915, to December, 1917	10,727.61
	93,322.56

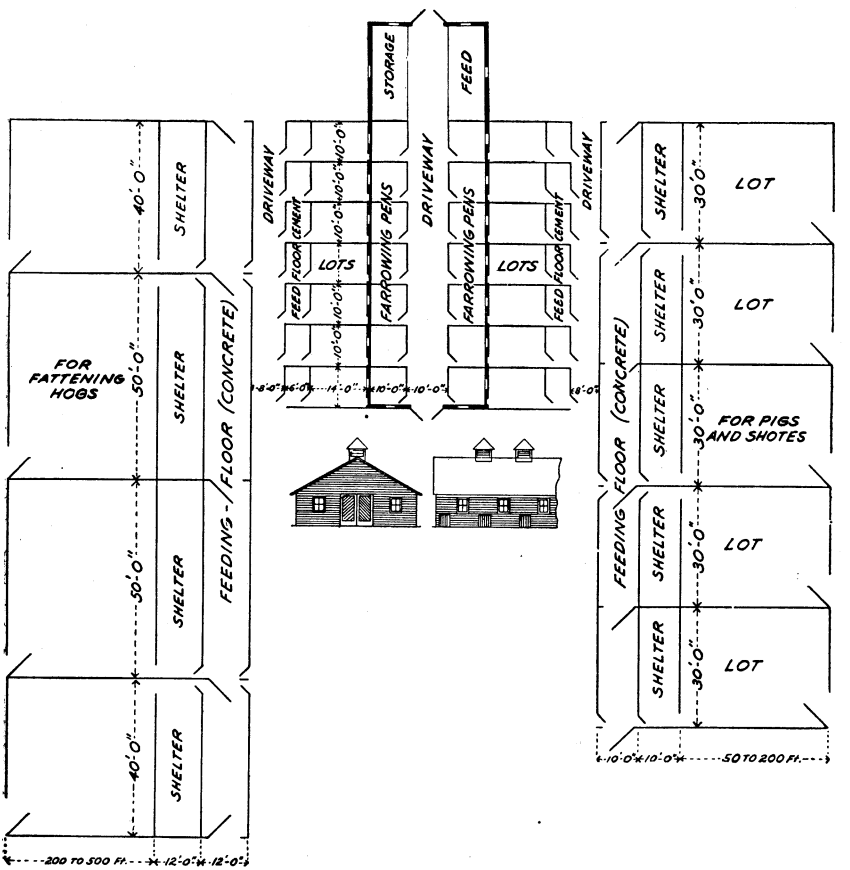

FIG. 15.—Suggested arrangement of plant for feeding garbage to hogs.

The estimated operating expense during the period (based on the statement of expenses for 1917) is $33,750, making a net return of over $59,000 for 2 years and 3 months of operation.

None of the foregoing figures include depreciation or interest on money invested in livestock. Depreciation on buildings is covered by repairs made, while the farm itself is considered as suffering no depreciation.

No credit has been allowed for manure produced, although its quantity was so great that no other fertilizers were purchased for use on the entire farm of 596 acres.

Additional figures on results of garbage feeding are given by Dr. B. T. Woodward, veterinary inspector at United States Naval Academy, Annapolis, Md., who reports an experiment with 110 pigs averaging 101 pounds each. Six pigs died within 10 days of arrival, and 1 died after four months' feeding.

Summary of experiment at Annapolis, Md.

Average time on raw garbage not supplemented with pasture or any other ration	days	123
Average gain, live weight	pounds	119
Average dressed weight	do	186
Average dressing per cent	do	84.8
Purchase price per pound	cents	17¼
(The purchase price includes cost of the swine, cost of immunization, quarantine, freight, attendant expenses, and expenses on purchasing trip.)		
Average sale price per pound, dressed	cents	25
Average gain (per hog)		$27.57

SUNDRY GARBAGE PRODUCTS.

Prior to the World War thousands of tons of garbage were collected and subjected to various treatments, resulting in grease, commercial fertilizer filler, and various sundry products. In many cases rendering vats were used to extract the grease, which was then skimmed off, put into barrels, and sold for various purposes. The residue was carefully graded, in some cases run through steam evaporators, concentrated, and given the trade name of "stick." This product, which is of about the consistence of molasses, contains a great deal of sugar. An analysis made by the New Jersey station showed that it contained the following nutrients:

	Per cent.
Moisture	61.00
Nitrogen	1.30
Ash	5.81
Carbohydrates	31.89

SUMMARY OF OBSERVATIONS AND EXPERIMENTS.

Among the points of practical application in feeding garbage to swine, the following are of particular importance in the light of present knowledge on the subject:

The waste-food products of more than 8,000,000 people are being fed to swine and fully 40,000,000 pounds of garbage-fed pork are sold annually.

Garbage varies greatly in composition, but on an average and allowing for normal losses, a ton of municipal garbage may be expected to produce 40 pounds of marketable live weight of hog.

The garbage must be collected with reasonable frequency and be free from tin cans, soap, broken glass, and other undesirable or injurious foreign articles. The public should be kept informed that garbage is being fed.

Usually it is best for the cities to make the garbage collections and then dispose of the garbage to individuals, associations, or cor-

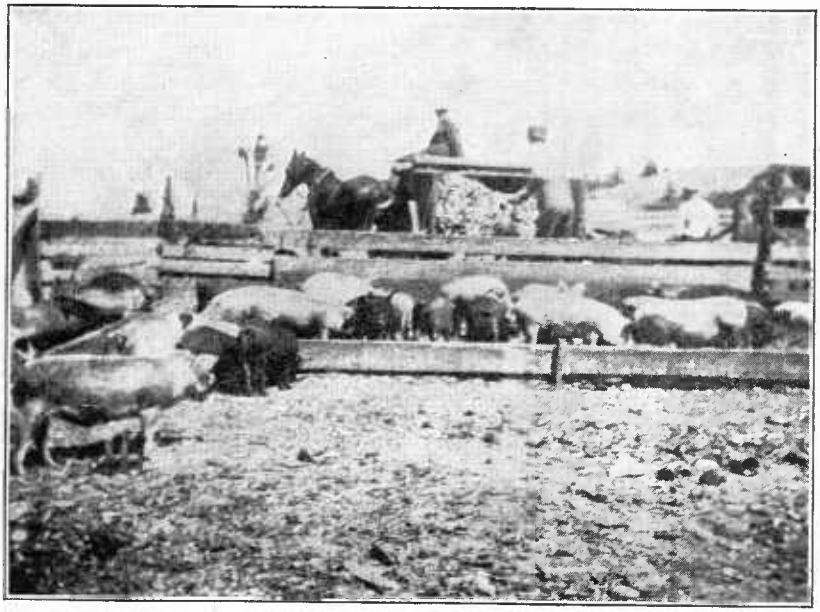

FIG. 16.—Garbage-feeding plant, Hull, Mass. Dumping the garbage on to the feeding platform.

porations on a contract basis, unless the city operates its own hog-feeding farm.

Long-time contracts are likely to be most satisfactory to all concerned; besides they tend toward a better class of equipment and more sanitary conditions.

The pigs to be fed may be bought as feeders or may be raised. Each method has given good results under suitable conditions.

Methods of feeding, handling, housing, and care may differ considerably so long as the essentials of sanitation and hog comfort are observed. Equipment for feeding should be adapted to the type of garbage available and to local conditions, climate, and transportation.

Raw garbage generally is better for hogs than cooked garbage. Frozen garbage, however, should be thawed before feeding.

As a rule the use of grain as a supplementary feed for the garbage is not an economical practice, but may be used to advantage when the supply of garbage is temporarily short.

Hogs to be fed garbage need to be immunized against cholera, preferably by the double or simultaneous treatment. Thorough immunization is very important because of the presence of raw pork scraps frequently deposited in garbage cans.

Garbage-fed hogs show no greater susceptibilty to tuberculosis, pneumonia, or kindred diseases than grain-fed animals.

Pork from garbage-fed hogs is as good in quality as pork resulting from other feeds, and average garbage-fed hogs sell at practically the same prices as average grain-fed animals.

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October 1, 1923.

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